Prepared for:

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DATA SUMMARY AND DISCUSSION

Reeves Southeastern Galvanizing Corporation Superfund Site Tampa, Florida

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EXECUTIVE SUMMARY

This report presents a data summary and discussion of conditions at the Reeves Southeastern Galvanizing Corporation Superfund Site in Tampa, Florida (Reeves Superfund Site). The report was prepared on behalf of Valmont - Southeastern Galvanizing, Inc., (VSG) the current owner of the former Industrial Galvanizers of America (IG). IG (and more recently VSG) has leased a portion of the property located at 9520 East Broadway, Tampa, Florida (Reeves Property) since 1996. The purpose of this report is to provide clarity regarding a number of issues that have been identified by others about the Reeves Property. Subjects addressed include history of the Reeves Property, media impacts, the Environmental Consulting Technology report, and potential deficiencies with the characterization and Focused Feasibility Studies that have been performed for the Reeves Superfund Site to date.

Reeves Property History

The Reeves Property has had a long history (approximately 50 years) of heavy industrial use including metal galvanizing, anodizing, and plating operations, most of which predate IG's operations at the site. In addition, unlined industrial wastewater percolation ponds, industrial wastewater treatment systems, and associated conveyance systems were utilized at the Reeves Property in the past and uncontrolled industrial wastewater discharges reportedly occurred across the Reeves Property for many years. Also, waste materials, including a zinc kettle, waste acid sludge, and other materials, were reportedly buried on the property prior to IG's operation at the Reeves Property and could be an ongoing source of groundwater contamination.

Media Impacts

Various media at the Reeves Property, including soil, sediment, surface water, and groundwater, have been impacted by constituents of concern (COCs) (primarily zinc, but also including arsenic, cadmium, chromium, lead, and nickel) that resulted from historical operations. Shallow, unsaturated zone soils containing COCs above the Performance Standard were excavated and disposed off-site as part of the Operating Unit No. 1 (OU1) cleanup in 1997.

Elevated zinc levels have been detected in surface water throughout the history of the Reeves Property. Surface soils contain elevated zinc levels and will likely continue to be a significant source for zinc in surface water in the future. In addition, there is strong evidence that there is an upward gradient between groundwater in the Transition and Sand Zones and that shallow groundwater is discharging to the surface at the northwest portion of the Reeves Property. EPA has clearly acknowledged this evidence and, therefore, has proposed that a portion of the swales located in and near the northwest area of the Reeves Property be lined to prevent historically-contaminated groundwater from discharging to surface water in that area

The lowest pH values and the highest COC levels in groundwater were observed in three primary locations: down-gradient of the former galvanizing building, at the northwest boundary of the Reeves Property (in the area where data indicate that groundwater is flowing to the surface), and down-gradient from the former wastewater ponds. At the southwest corner of the Reeves Property, low pH and volatile organic compounds (including vinyl chloride) were detected in groundwater and are reportedly a result of impacts from the up-gradient Peak Oil/Bay Drum site that have migrated onto the subject property.

Elevated and widespread sulfate levels in groundwater indicate that groundwater impacts largely predate IG's operations at the Reeves Property (IG and VSG primarily utilized

hydrochloric acid, whereas the former operations utilized sulfuric acid; both operations used zinc ammonium chloride).

Environmental Consulting Technology (ECT) Report and Best Management Practices

In 2009, at the request of IG, Environmental Consulting Technology (ECT) attempted to evaluate areas where ongoing operations could be contributing zinc to stormwater and, therefore, might warrant the development of additional best management practices (BMPs) (ECT, 2009). The evaluation included collection of "simulated stormwater runoff", ambient air, and surface soil samples. Unfortunately, the report contained numerous factual and procedural errors and did not present an accurate picture of current conditions. Nevertheless, one of the key conclusions from the ECT report was that "the zinc concentrations reported in simulated runoff samples did not represent an anticipated zinc concentration in stormwater runoff."

Numerous stormwater BMPs were implemented beginning in the late 1990s soon after IG leased the Facility, and have continued to be adopted and improved during subsequent years in order to minimize zinc concentrations in stormwater and prevent zinc from migrating off-property. These have included:

- Site paving;
- daily sweeping of the property;
- material dressing conducted under cover;
- Central Ditch lined with concrete, baffles with limestone gravel and filters installed; and
- roof rainwater collection system installed.

Reeves Property Characterization

Although numerous investigations have been performed at the Reeves Property to date, there are some potential COC source areas that should be further characterized. Areas of the Reeves Property that appear to be ongoing sources of groundwater contamination include the former galvanizing building and the former industrial wastewater pond areas.

All potential pathways for contaminant migration should be addressed as part of the cleanup of the Reeves Superfund Site. For example, vertical gradients (which suggest both downward and upward migration of groundwater at different parts of the property) in groundwater have been ignored in prior investigations and need to be assessed.

Focused Feasibility Study

The approach for groundwater remediation proposed in the Focused Feasibility Study (FFS) reports (ARCADIS, 2010 and 2011) was in-situ chemical injection. Based on a review of the conceptual chemical injection patterns illustrated in the FFS, it is apparent that source areas will largely not be treated with chemical injection, but rather only a small portion of the dissolved COC plume will be treated. This will only be effective in the short term, and additional injections will ultimately have to be conducted as the reductant concentrations dissipate over time. For full site remediation to occur, a dense grid of injections must be conducted throughout all source areas.

In the FFS report, it is asserted that zinc concentrations in surface water are a result of IG's operations and that metals in surface water were preventing ARCADIS from achieving the Operating Unit No. 2 Record of Decision (OU2 ROD) goals for groundwater. Zinc levels were present in all surface water samples collected at the site prior to 1996. Levels detected in surface water at the northwest (downgradient) boundary of the Reeves Property prior to 1996

ranged from 11 milligrams per liter (mg/L) to 629 mg/L. This shows that elevated zinc levels were present in surface water prior to IG's operations at the Reeves Property (IG's operations began in 1996, while VSG acquired IG's parent in 2010). Further, the Five Year Report for 1996 stated that "discharge of site-impacted groundwater to the Unnamed Creek and the drainage swale is the most likely source of this contamination." Available historical data suggest that potential discharges to air or surface water related to ongoing operations by IG/VSG are insignificant compared to pre-1996 impacts caused by former site operations.

Summary of Conclusions

In summary, a review of the historical record and data collected for the site resulted in the following key conclusions:

- In the spring of 2001, ARCADIS entered into an Operation, Maintenance and Monitoring (OMM) Agreement with Reeves under which ARCADIS agreed to conduct and complete all remedies required by EPA for OU2 and OU3 at the site. ARCADIS' remedial obligations under this Agreement apply to all OU2 and OU3 conditions that existed at the site as of the effective date of the Agreement - April 11, 2001.
- Prior to 2001, the site was the location of at least 35 years of metal finishing and hot dip galvanizing operations that started in the 1960s. These historical operations included the use of two unlined percolation ponds along the northern Reeves Property boundary from the mid-1960s until 1982 that were used for the disposal of acidic wastewater containing high concentrations of zinc, chromium, and iron. From 1982 to 1996, industrial wastewater was managed in an on-site pretreatment system located adjacent to the two ponds.
- Historical operation of the two ponds, the pretreatment system, the metal finishing and galvanizing plant, as well as probable spills/releases, during the 1960s and continuing through the 1980s caused significant quantities of pollutants to enter site soils, surface water, sediments and groundwater. These conditions led to the U.S. Environmental Protection Agency (EPA) listing the site on the National Priorities List (NPL) in 1983.
- Contrary to allegations raised by ARCADIS, the site cleanup is still being driven by historical contamination. Based on a review of available historical data, the scale of the historical contamination would be expected to be substantially and materially greater than alleged post-1996 impacts.
    - Groundwater data from Monitoring Well S2 (one of the few wells for which pre-1996 data are available, and located outside the area influenced by ARCADIS' groundwater remediation pilot studies) provide an illustration of this situation. Prior to 1996, the zinc concentrations in groundwater at S2 ranged from about 107 mg/L in 1995 to 369 mg/L in 1989. More recently, during 2001 to 2013, zinc concentrations in groundwater at S2 have ranged from a low of 23 mg/L in 2003 to a high of 288 in 2000. These data indicate a gradual decreasing trend of zinc concentrations in groundwater over time and do not indicate significant impacts to groundwater post 1996 or post-2001.
    - Analysis of site data indicates that groundwater is upwelling in the northwestern portion of the site, which could cause historically-contaminated groundwater to enter surface water. The area affected by this upwelling of groundwater entering surface water includes the area where the Unnamed Creek joins with the North and West Swales (which run roughly parallel with the northern and western edges of IG's leased parcel, respectively).

        - ARCADIS' assertion that surface water is impacting groundwater quality is not valid given the site data that indicate upwelling locations where contaminated groundwater can affect surface water.
        - In addition, because of the upwelling and the elevated zinc concentration in soil, surface water and sediment data reported by ARCADIS for locations within the upwelling area are likely more representative of soil and groundwater impacts than stormwater impacts.
    - The North Wetland receives stormwater primarily from road ditches located on the north and south sides of East Broadway Avenue, and runoff from the railroad right-of-way, Peak Oil/Bay Drum Superfund Site and Master-Halco operations (formerly Reeves Southeastern Wire) located on the south side of East Broadway.
    - In addition, the lack of apparent increasing trends in the available surface water data for the North Wetland and Unnamed Creek do not indicate appreciable impact from IG or VSG operations at the site.
- Residual conditions at the site that are attributable to pre-1996 operations are a potential ongoing, contributing source of zinc contamination in stormwater, sediment, and groundwater.
    - EPA has approved cleanup standards for groundwater at the site that include a groundwater cleanup standard for zinc of 10 mg/L; however, based on the upwelling of groundwater across the northwestern portion of the site, groundwater with zinc concentrations up to the cleanup standard of 10 mg/L could continue to adversely impact sediments and surface water.
    - EPA also has approved a soil cleanup standard for zinc of 10,860 milligrams per kilogram (mg/kg). Zinc-contaminated soils and sediments at these levels could contribute zinc at substantial concentrations in stormwater.
        - Prior to implementing the OU1 remedy for soil and sediments, zinc concentrations in the soil and sediments at Reeves' two percolation ponds were as high as 209,474 mg/kg. In addition, prior to 1996 zinc concentrations in soil across other portions of the Site ranged from 6.3 mg/kg to 113,000 mg/kg, while zinc concentrations in sediment ranged from 80 mg/kg to 120,000 mg/kg.
        - EPA's 1995 determination that the OU1 cleanup had been satisfactorily completed was based on compliance with the 10,860 mg/kg standard in unsaturated zone soil. However, use of this cleanup standard allowed residual zinc concentrations at many areas of the site to remain in place so long as the soil concentrations were below 10,860 mg/kg for zinc, thereby leaving many thousands of pounds of zinc in the site soil and sediment.
        - Similarly, analysis of the historical data collected by EPA and Reeves' contractors suggests that sub-grade soils in the vicinity of the former Reeves galvanizing building may also be continuing to contribute zinc and other contaminants to groundwater.
- Starting in 1996, IG began implementing a series of improvements to limit and/or control pollutants that could potentially reach the ambient air, soil, and surface waters.
    - Emissions of regulated air pollutants have been subject to applicable Florida state and local permit requirements, and baghouses have been used to control

kettle emissions since at least 1996. Baghouses in use since 2003 are rated as having 99.9% capture efficiency for particulate matter.

- Similarly, stormwater management has been performed pursuant to applicable permit requirements specified by Florida state regulators. In addition, BMPs have been implemented and improved upon over the years.
- Since 2010, IG has continued to implement additional BMPs in accordance with its stormwater permit requirements and discussions with state regulators. The facility's stormwater discharges are authorized by permit. Potential exceedances of stormwater general permit "benchmark" numbers for zinc are not relevant to determining the facility's environmental regulatory compliance status. The benchmark numbers are not enforceable discharge limits but rather are used to identify constituent concentrations at which the continued use of BMPs is appropriate. As stated in the EPA, Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, Part 6.2.1 (amended May 27, 2009), *"benchmark concentrations are not effluent limitations; a benchmark exceedance, therefore, is not a permit violation. Benchmark monitoring data are primarily for your use to determine the overall effectiveness of your control measures and to assist you in knowing when additional corrective action(s) may be necessary to comply with the effluent limitations in Part 2".*

- The 2009 zinc assessment report by ECT was prepared in response to specific data requests by Florida state regulators, and was not intended, nor is it appropriate, for site characterization purposes. As ECT itself expressed within this report, the data contained in the report "do not represent expected stormwater zinc concentrations, but rather "are only valid to assess the relative quantities of zinc present" under ECT's biased sampling approach and overly aggressive/conservative sampling protocols.

1.0 INTRODUCTION

1.1 Purpose

This report presents a data summary and discussion of conditions at the Reeves Southeastern Galvanizing Corporation Superfund Site in Tampa, Florida (Reeves Superfund Site). The report was prepared on behalf of Valmont - Southeastern Galvanizing, Inc. (VSG), the current owner of the former Industrial Galvanizers of America (IG), which currently leases a portion of the property located at 9520 East Broadway, Tampa, Florida (Reeves Property). The purpose of the report is to provide clarity regarding a number of issues about the Reeves Property that have been identified by others.

1.2 Reeves Property Description

The Reeves Property is located on an approximately 17.4-acre site at the north side of State Road 574 (East Broadway Avenue), approximately 1,200 feet west of Falkenburg Road, Hillsborough County, Tampa, Florida (**Figure 1)**. The Reeves Property is divided into two parcels (Reeves Southeastern Corporation and Reeves Southeastern Realty) that are shown on **Figure 2A**. VSG currently leases the approximately 10-acre Reeves Southeastern Corporation property shown on **Figure 2A** (referred to herein as the IG Facility).

The North Wetland is located immediately to the west of the Reeves Property and covers an area of approximately 1.8 acres. The Unnamed Creek borders the west side of the Reeves Property and traverses diagonally in a north-northeasterly direction across the northwest property corner as shown on **Figure 2A**. Aerial photographs from the 1950s indicate that both the North Wetland and Unnamed Creek predate development of the Reeves Property (ARCADIS, 2010).

The land use in the vicinity of the Reeves Property includes mixed-commercial, light-manufacturing, and office buildings. The nearest residential property is more than 0.25 mile southeast of the Reeves Property (LFR, 2007). Another federal Superfund site, the Peak Oil/Bay Drum Superfund Site, is located immediately south of the Reeves Property across East Broadway Avenue (Canonie, 1992). Master Halco (formerly Reeves Southeastern Wire) is also located to the south of the Reeves Property.

1.3 Reeves Property History

The Reeves Property was originally developed in the mid-to-late 1960s and was operated as Acme Plating and Galvanizing Company. In 1970, the facility was acquired by Metal Coatings, Inc., which merged into the Southeastern Galvanizing Corporation in 1971. Through internal reorganizations, Southeastern Galvanizing Corporation became the Southeastern Galvanizing Division of Reeves Southeastern Corporation (Canonie, 1992).

On March 1, 1996, Reeves Southeastern Corporation sold certain assets used in its galvanizing operation and leased approximately 10 acres of the galvanizing facility and related buildings to IG (EPA, 2011). IG conducted galvanizing operations at the former Reeves galvanizing building from 1996 until a new galvanizing building was constructed on the southwest portion of the property in 2000. VSG conducts hot-dip galvanizing operations in the new galvanizing building (the old building was demolished in 2007). Locations where prior operations at the Reeves Property occurred are shown on **Figure 2A**. A historical time-line for the Reeves Superfund Site is included on **Figure 2B**.

The hot-dip galvanizing process conducted at the IG Facility entails dipping or immersion of steel products into a series of cleaning (caustic), rinse, and surface treatment (acid pickling

liquor) tanks before immersion in a molten zinc bath (AGA, 2007). A chromate quench tank cooling water bath is often utilized after immersion in the zinc bath.

In an attempt to better understand the chemical use history at the Reeves Property and potential for contamination from prior operations, IG personnel spoke with former employees of the Reeves Wire and Reeves Galvanizing operations, including an individual who subsequently worked at the IG Facility. These discussions and related review of available Site records/reports have suggested the following.

- Reeves Wire may have dumped acid along the railroad tracks north of their facility (upgradient of the subject Reeves Property).
- Acme Plating operated at the subject property prior to Reeves. Anodizing operations were conducted in the building that was used by IG as the chemical storage building.
- The building that was used by IG for storage (north of the current office) was used for metal plating operations prior to 1996.
- The former Reeves Galvanizing process tanks were originally constructed of granite, which was epoxied together. The tanks would leak periodically and had to be re-epoxied.
- During Reeves' operations, stormwater would often flow into the old galvanizing building and would flow out the north door.

The metal-coating operations at the Reeves facility generated process wastewater that was discharged into two evaporation/percolation ponds until 1982, when an industrial wastewater pre-treatment system was installed and the facility began discharging its industrial wastewater into the local publicly owned treatment works (EPA, 2011). IG terminated the use of the onsite pre-treatment system after it commenced operations in 1996, and instead shipped its spent acid and related wastewaters offsite for disposal.

An operational change between Reeves' and IG's tenure at the Reeves Property provides a method of estimating the approximate time frame for when groundwater contamination occurred at the property (this has not been discussed in prior reports prepared for the Reeves Superfund Site). The galvanizing process involves a "pickling" stage in which a steel part or product is dipped in an acid tank to remove iron oxides from the steel. Reeves primarily used sulfuric acid for the pickling process, whereas IG primarily used hydrochloric acid. Accordingly, a release during Reeves' tenure would be evident due to an extensive amount of sulfate and zinc, with some chloride, in the groundwater. In contrast, a recent release to groundwater would contain chloride and zinc, but not sulfate. This subject is further discussed in Section 3.2.

Numerous stormwater BMPs were implemented beginning in the late 1990s soon after IG leased the Facility, and have continued to be adopted and improved during subsequent years in order to prevent zinc from migrating off-property. These have included:

- Site paving;
- daily sweeping of property;
- material dressing conducted under cover;
- Central Ditch lined with concrete, baffles with limestone gravel and filters installed; and
- roof rainwater collection system installed.

1.4 Project History

EPA performed an investigation of the Reeves Property in 1981and discovered elevated concentrations of metals in surface water and groundwater at the property (EPA, 2011). In August 1982, the Florida Department of Environmental Protection (FDEP) conducted an expanded investigation of the Reeves Property, which resulted in the placement of the Reeves Property and the Reeves Southeastern Wire facility (located across the street to the south of the Reeves Property) on the EPA's National Priorities List in 1983 (EPA, 2011). Reeves Southeastern Wire received a "No Further Action" determination from the EPA in 2001 (EPA, 2001).

In 1988, the Reeves Southeastern Corporation and a group of potentially responsible parties (PRPs) for the adjacent Peak Oil/Bay Drum Superfund Site signed individual Administrative Orders of Consent (AOCs) to perform source characterization Remedial Investigation and Feasibility Studies (RI/FS) at their respective sites and a joint AOC for the area-wide groundwater RI/FS. The source characterization RI/FS was performed between 1989 and 1992. The EPA also conducted a Wetland Impact Study for the North Wetland.

After the source characterization and area-wide groundwater RIs were completed, the EPA established the following three operable units (OUs) to address affected media at the Reeves Superfund Site:

- OU1 (Record of Decision (ROD) issued 1992): source removal of impacted soils and sediments.
- OU2 (ROD issued 1993): monitoring and natural attenuation of northern surficial groundwater.
- OU3 (ROD issued 1994): monitoring of the North Wetland.

The OU1 source area remedy was completed in October 1997 (EPA, 2011). The OU1 excavation areas are shown on **Figure 3**. As shown on **Figure 3**, soil excavation was performed at only limited areas of the Reeves Property, and did not include areas beneath the former galvanizing building (which was not demolished until 2007) and in the drainage areas northwest of the Reeves Property. Both areas would have been impacted by historical operations.

Soil and sediment removal action levels (performance standards) from the OU1 ROD were as follows:

Table 1. ROD Soil and Sediment Removal Action Levels

Chemical	Performance Standard (mg/kg)
Chromium	69
Lead	280
Zinc	10,860
Notes: mg/kg= milligram/kilogram Source: EPA, 1993	

The selected remedy for OU2 (surficial groundwater) was source control/monitoring with the following stipulations:

- Preparation of a contingency remedy to be implemented in the event that levels of the constituents of concern (COCs) were not reduced within 2.6 years of completion of OU1.

- Construction of an engineered barrier to prevent the discharge of groundwater from the Surficial Aquifer into the Unnamed Creek at the northwest corner of the Reeves Property.

The groundwater COCs and Performance Standards presented in the OU2 ROD are shown in the following table:

Table 2. Constituents of Concern in Groundwater

Parameter	PS [1] (µg/L)
Arsenic	50
Cadmium	5
Chromium (total)	100
Lead	15
Nickel	100
Zinc	10,000

Notes:
[1] Performance Standard from the OU2 ROD.
µg/L= microgram per liter
Source: EPA, 1993

An engineered barrier to prevent the discharge of groundwater from the northern Surficial Aquifer into the Unnamed Creek at the downgradient Reeves Property boundary was approved by the EPA and construction was completed in January 2004 (EPA, 2011). EPA concluded in 2005 that the COCs in groundwater were not decreasing at an acceptable rate and requested that an alternate in-situ treatment approach be evaluated in place of groundwater pump/treat, which was the contingent remedy. As a result, additional characterization and pilot testing were performed as documented in the Additional Characterization and In Situ Groundwater Treatment Pilot Study Report (LFR, 2007).

A Focused Feasibility Study (FFS) for the Reeves Superfund Site was submitted in March 2010, which proposed an in-situ remedial approach for groundwater (ARCADIS, 2010). The EPA/FDEP requested that further delineation and an evaluation of available injection approaches be performed. In July 2011, a revised FFS (ARCADIS, 2011) was submitted to address the EPA/FDEP comments. The revised FFS recommended in-situ treatment via chemically- induced sulfide precipitation, swale lining or armoring, monitored natural attenuation (MNA), and institutional controls. The FFS is still pending approval.

A Pre-Design Work Plan was submitted for the Reeves Superfund Site to EPA and FDEP on November 29, 2011 to further address comments regarding development and refinement of a final remedial approach (ARCADIS 2011). Conditional approval of the Pre-design Work Plan was provided on March 23, 2012. However, the in-situ pilot test has not been approved.

The OU3 ROD for the North Wetland selected the No Action/Monitoring alternative as the remedy. The remedy consisted of an ecological assessment of the wetland for a period of eight years, to be extended beyond eight years if the OU2 remedy for northern surficial groundwater was extended.

2.0 SITE CONDITIONS

2.1 Topography

The land surface at the Reeves Property slopes generally to the west-northwest. Surface elevations range from approximately 42 feet above mean sea level (msl) at the southeast corner of the Reeves Property to 28 feet above msl at the northwest corner of the property (ARCADIS, 2011).

2.2 Soil

Surface soils at the Reeves Property have been categorized by the United States Department of Agriculture, Soil Conservation Service as the Myakka, Pomello, and St. Johns soils (USDA, 1989). These soils are similar in nature, and are fine-grain, sandy soils, with moderate to rapid permeability. These soils are naturally acidic to moderately acidic, ranging from a pH of 3.6 to 6.5 standard units. Clay content is generally less than 2 percent. The soils are classified under the Unified Soil Classification System as SP and SP-SM (poorly graded sands to silty sands). In addition, soil samples at the Reeves Property have been noted as also containing various fill materials, including shells and limestone (SEC Donohue, 1992a).

2.3 Surface Water

Surface water flows into the North Wetland from the East Broadway road ditches, which receive drainage from East Broadway, the railroad tracks and the Peak Oil/Bay Drum Superfund Site to the south. Stormwater exits the North Wetland and flows northeast into the Unnamed Creek, which crosses the northwest corner of the Reeves Property. The Unnamed Creek is joined at the northern Reeves Property boundary by drainage swales (North and West Swales) that carry stormwater runoff from the property. The locations of the Unnamed Creek and the North and West Swales are shown on **Figure 2A**.

IG stormwater Outfall 001 discharges into the West Swale, as shown on **Figure 2A**. The North Swale largely receives stormwater flow from the former pond area, located north of the IG Facility (the area was regarded as part of OU1 and was regraded to drain into the North Swale). After combining with the North and West Swales at the northwest boundary of the Reeves Property, the Unnamed Creek flows into a concrete conveyance system (installed in 2004 as part of OU2) located at the northwestern corner of the Reeves Property. The conveyance system discharges approximately 100 feet north of Queen Palm Drive into an unlined portion of the Unnamed Creek. Surface water eventually flows into a stormwater-detention pond at Sabal Industrial Park. The outflow from the detention pond flows into the Tampa Bypass Canal.

The Unnamed Creek is an intermittent stream that is largely dry except during the summer months, which are the wettest part of the year (ARCADIS, 2010). However, the portion of the Unnamed Creek at the northwest corner of the Reeves Property typically contains standing water, which is likely the result of groundwater upwelling in the area. This is discussed further in Section 2.4.5.

2.4 Hydrogeology

2.4.1 Hydrogeological Setting

The Southeastern Geological Society Committee on Florida Hydrostratigraphic Nomenclature (1986) established three major hydrogeologic units in peninsular Florida. In descending order, they are the Surficial Aquifer System (SAS), Intermediate Confining Unit (ICU), and the Floridan Aquifer System (FAS). These aquifer systems are composed of multiple, discrete aquifers separated by low permeability "semi-confining" to "confining" units that occur throughout this Tertiary/Quaternary system age sequence.

The groundwater system beneath the Reeves Property consists of two major units: the Surficial Aquifer and the underlying Floridan Aquifer. A low-permeability unit (Hawthorn Group) separates the Floridan Aquifer from the Surficial Aquifer (USGS, 1990).

2.4.2 Surficial Aquifer System

The unconfined SAS is found in undifferentiated Holocene to Pleistocene sediments from land surface to the top of the intermediate confining unit. The water table occurs close to land surface and recharge is received from direct rainfall. Regionally, the SAS is comprised of undifferentiated sand and shells from land surface to approximately 50 feet below ground surface (bgs) (Reese and Richardson, 2007). The surficial aquifer is generally composed of alternating layers of poorly to well-consolidated, highly porous and permeable sand and shell material. Porosity in this aquifer is primarily intergranular. The SAS is considered a Class IIB Aquifer, but is not currently utilized for groundwater supply (EPA, 2010).

At the Reeves Property, the SAS is comprised of undifferentiated sediments, which generally range in thickness from 9 to 37 feet (Canonie, 1992). Recent sampling data confirmed that the undifferentiated surficial sediments are predominantly poorly graded sands and silty sands, which have been designated as the "Sand Zone" (LFR, 2011) within the SAS. In many areas of the Reeves Property, a gradational zone also exists between the Sand Zone and the underlying Hawthorn Group (ICU). The gradational zone is comprised of clayey sand and has been designated as the "Transition Zone" (ARCADIS, 2011).

Hydraulic testing (slug tests and short-term pumping tests) performed in the Sand Zone of the SAS indicated an average hydraulic conductivity of 18.9 feet per day (ft/day) (SEC Donohue, 1992b). LFR estimated the groundwater horizontal seepage velocity to be approximately 690 feet per year (ft/year) (LFR, 2011).

Hydraulic tests (slug tests and pumping tests) performed in the Transition Zone of the SAS indicated an average hydraulic conductivity of 0.4 ft/day (ARCADIS, 2011). LFR estimated a groundwater seepage velocity in the Transition Zone of approximately 10 ft/year.

Although the Sand Zone and the Transition Zone are comprised of different materials and have different permeabilities, they are still in hydraulic communication, and comprise the SAS. Studies performed to date have mapped the groundwater potentiometric and geochemistry data for the two zones separately. Given the hydraulic connection between the zones, mapping them separately could lead to incorrect interpretations of the data. This subject is discussed further in Section 3.2.

2.4.3 Hawthorn Group Intermediate Confining Unit

The ICU (Hawthorn Group) is a complex hydrogeologic unit that is broadly characterized by three hydrogeologic settings (Arthur et al, 2008):

- Relatively thin, laterally discontinuous permeability with confining to semi-confining sediments that provide local hydraulic separation between the SAS and FAS;
- Low permeability confining to semi-confining sediments hydraulically separating the SAS from the FAS; and
- Interlayered sequences of permeable and less permeable rocks and sediments separating the SAS from the FAS.

The ICU consists of the low permeability confining units of the Peace River Formation of the Hawthorn Group. Based on previous investigations, the Reeves Property lies within the first of these hydrogeologic settings. The thickness of the underlying Hawthorn Group, which generally consists of sandy clay and clay, was previously reported to be approximately 15 to 40 feet thick (Canonie, 1992).

2.4.4 Floridan Aquifer System

The FAS (Floridan Aquifer System) is defined as a vertically continuous sequence of permeable carbonate rocks of Tertiary age that are hydraulically connected to varying degrees, and whose permeability is generally several orders of magnitude greater than that of the rocks that bound the system above and below (Miller, 1986). The aquifer system is subdivided into the Upper Floridan aquifer, Middle Floridan aquifer/Avon Park Permeable Zone, and the Lower Floridan aquifer based on hydraulic characteristics.

The Upper Floridan aquifer is composed of a series of permeable carbonate sediments within the Tampa Limestone and Suwannee Limestone. The Middle Floridan aquifer/Avon Park Permeable Zone is composed of the upper portion of the Avon Park Formation. The Lower Floridan aquifer consists of the early Eocene Oldsmar Formation. The Upper Floridan Aquifer underlies the Hawthorn Group.

The Floridan Aquifer is the primary source of drinking water and water for industrial use in Hillsborough County (EPA, 2011). However, there are no permitted wells in the vicinity of the Reeves Property and the area has been designated as a Florida Groundwater Delineated Area. The Floridan Aquifer consists of a thick sequence of limestone and dolomite of Tertiary age and is considered a regional aquifer (USGS, 2005).

2.4.5 Groundwater Flow Direction

Rainfall infiltrates the permeable surficial materials and, after percolating downward to the water table, moves laterally and discharges to surface streams and wetlands (LFR, 2011). Water levels within the surficial groundwater seasonally fluctuate and change rapidly in response to rainfall and other natural events.

The groundwater flow direction in the Surficial Aquifer (SAS) beneath both the Reeves Property and the Peak Oil/Bay Drum Superfund Site is toward the west-northwest (LFR, 2011). The average horizontal hydraulic gradient is approximately 0.01 ft/ft in the Surficial Aquifer.

The horizontal component of groundwater flow has been well documented in various studies of the Reeves Superfund Site. However, none of the Reeves Superfund Site investigation reports reviewed discussed the vertical component of groundwater flow. Groundwater data from clustered monitoring well pairs completed in the Sand and the Transition Zones were compared to evaluate differences in potentiometric surface between the zones (ARCADIS, 2013). Given

that the zones are in hydraulic communication, a difference in potentiometric head (or hydraulic head) provides an indication of the direction of groundwater flow in the area of the wells (Freeze and Cherry, 1980). For example, if the potentiometric surface in the Sand Zone was at a higher elevation than in the Transition Zone at a location (a positive difference in head), this would indicate a tendency for groundwater to flow downwards from the Sand Zone into the Transition Zone. If the opposite condition was found (negative difference in head), then flow would tend to occur from the Transition Zone upwards towards the Sand Zone. Evaluation of vertical gradients within the aquifer is important when evaluating contaminant migration pathways.

Groundwater head differences were calculated using data collected in 2012 (ARCADIS, 2013) from clustered monitoring wells. These data are presented on **Figure 4**. **Figure 4** indicates a downward vertical gradient exists between groundwater in the Sand and Transition Zones across the majority of the Reeves Property, except for the northwestern quarter of the property. Downward groundwater gradients would cause liquids that were infiltrating through the Surficial Aquifer (such as spilled processing fluids that were released during pre-1996 operations, which are assumed to be denser than water) to sink towards the Transition Zone. Based on available data, downward gradients exist in the areas near the old galvanizing facility, the plating building, the anodizing building, and the closed pond areas (most of which were not operated after 1996, and only the old galvanizing building was operated between 1996 and 2000 when the new galvanizing building was opened) Groundwater gradients appear to become upward in the vicinity of the wetland areas at the northwestern portion of the Reeves Property (which commonly occurs in wetland areas).

The groundwater potentiometric surface elevations in shallow (Sand Zone) piezometers installed at the northwestern portion of the Reeves Property were all higher than adjacent ground surface elevations in August 2012 (ARCADIS, 2013), as shown on **Figure 4**. This indicates that groundwater is moving upward and flowing to the surface in this area. Based on the upward gradient, the shallow depth to groundwater, and the sandy nature of the soils, available data indicate that groundwater is flowing upwards from the Transition Zone through the Sand Zone and then flowing to the surface in the wetland areas.

3.0 MEDIA IMPACTS

3.1 Groundwater

A series of isopleth maps were prepared largely from the groundwater sample analytical data set presented in the report titled: Additional Characterization and In Situ Groundwater Treatment Pilot Study Report, Reeves Southeastern Site, Tampa, Florida, December 6, 2007 (LFR, 2007a). Prior reports prepared for the Reeves Superfund Site have presented separate data maps for the Sand and Transition Zones. These two zones are part of the same aquifer and no apparent aquitard exists between them. Therefore, from a hydrogeologic perspective it is inappropriate to evaluate the two zones separately. Accordingly, the isopleth maps presented herein are for the combined data from the two zones. The lowest pH readings and highest parameter concentrations measured (primarily from 2006) in either the Sand or Transition Zone were utilized for contouring in order to evaluate potential source areas for groundwater contamination. The following parameters: pH, chloride, sulfate, lead, total chromium, and zinc, were identified as being representative of historical and more recent industrial uses at the Reeves Property, and were, therefore, utilized for isopleth map preparation. The isopleth maps are included herein as Figures 5 through 10 and are discussed below.

Figure 5 presents an isopleth map of pH concentrations in groundwater. As shown on **Figure 5**, the pH concentrations were measured at levels that ranged from 2.19 (DPT016) to 6.98 (G-3). Published pH data for the Surficial Aquifer (SAS) in the Tampa area ranged from approximately 4.8 to 6.2 units (Berndt, et al, 1998), which can be considered a range for background levels for the Reeves Property. The mean annual pH in precipitation in the area in 2012 was 5.13 units (NADP, 2014).

As shown on **Figure 5**, lower pH values were observed down-gradient of the former galvanizing building, at the northwest boundary of the Reeves Property (in the area where data indicate groundwater is flowing to the surface down-gradient from the former pond location), and at the southwest corner of the Site, in the vicinity of the North Wetlands. A groundwater investigation of the Bay Drum/Peak Oil Superfund Site, which included an off-site investigation of a portion of the Reeves Property, was performed in 2002 (De Maximis, 2002). Groundwater pH levels measured during the De Maximis' investigation (but not discussed in the De Maximis report) indicated that a low pH plume in groundwater was migrating onto the site from the south. These data were plotted on **Figure 5**.

Figure 6 presents an isopleth map of chloride concentrations in groundwater. As shown on **Figure 6**, the highest chloride level was observed down-gradient of the former galvanizing building (3,000 mg/L, DPT016). The chloride plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest. As discussed in Section 1.3, elevated chloride levels would be expected to be much more widely dispersed in groundwater if current operations were impacting groundwater. In addition, no significant chloride levels were observed in groundwater in the vicinity of the current galvanizing building, which would not be the case if current operations were impacting groundwater. Therefore, groundwater impacts are most likely related to operations that predate IG's tenure at the Reeves Property.

Figure 7 presents an isopleth map of sulfate concentrations in groundwater. As shown on **Figure 7**, the highest concentrations were measured at the northwest boundary of the Reeves Property in the area where groundwater is likely flowing to the surface (up to 12,000 mg/L, DPT004), down-gradient from the former pond location (up to 4,200 mg/L, MW002D), and down-gradient from the former galvanizing building (up to 620 mg/L, DPT016). As discussed in Section 1.3, elevated sulfate levels in groundwater indicate that groundwater impacts largely

predate IG's operations at the Reeves Property (IG utilizes hydrochloric acid, whereas the former operations utilized sulfuric acid in their processes).

Figure 8 presents an isopleth map of lead concentrations in groundwater. As shown on **Figure 8**, the highest concentrations were measured at the northwest boundary of the Reeves Property down-gradient from the former pond location (up to 1.3 mg/L, MW002D) and down-gradient from the former galvanizing building (up to 0.110 mg/L, DPT003). The lead plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest.

Figure 9 presents an isopleth map of total chromium concentrations in groundwater. As shown on **Figure 9**, the highest concentrations were measured at the northwest portion of the Reeves Property down-gradient from the former pond location (up to 3.4 mg/L, MW002D) and down-gradient of the former galvanizing building location (up to 0.400 mg/L, DPT002). The total chromium plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest.

Figure 10 presents an isopleth map of zinc concentrations in groundwater. As shown on **Figure 10**, the highest zinc concentrations were measured down-gradient of the former galvanizing building (up to 550 mg/L, DPT016) and at the northwest boundary (up to 1,500 mg/L, MW009) of the Reeves Property in the area where groundwater is likely flowing to the surface down-gradient from the former pond location. The zinc plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest. No significant zinc levels were observed in groundwater in the vicinity of the current galvanizing building, which would not be the case if current operations were impacting groundwater.

In the Peak Oil/Bay Drum investigation (De Maximis, 2002), numerous volatile organic compounds (including vinyl chloride) were detected in groundwater above FDEP Groundwater Cleanup Target Levels beneath the subject Reeves Property. These volatile organic compounds are likely migrating onto the Reeves Property from the Peak Oil/Bay Drum site. Metal analyses in groundwater were not included in the scope of work for the De Maximis investigation. Data from the Peak Oil/Bay Drum investigation are included in Appendix A.

3.2 Surface Water/Sediment

ARCADIS performs periodic surface water and sediment sampling adjacent to the North Wetlands, within the Unnamed Creek, and in both the North and West Swales at the Reeves Property (references cited in Section 6.0).The following zinc level ranges were detected in sediment between 1981 and 2012:

- North Wetland: 0.72 to 480 mg/kg (NW-01)
- Unnamed Creek: 20.5 to 31,400 mg/kg (NW-02R)
- West Swale: 2,610 to 16,000 mg/kg (DS-01)
- North Swale: 680 to 33,000 mg/kg (DS-02)
- North Site Boundary: < 14 to 28,000 mg/kg (UNC-01)

Surface water samples collected during the 1981 to 2012 period contained the following total zinc concentration ranges:

- North Wetland: 0.05 to 46 mg/L (NW-01)
- Unnamed Creek: 0.0087 to 2.2 mg/L (NW-02/R)
- West Swale: 0.93 to 66.6 mg/L (DS-01)
- North Swale: 0.18 to 15 mg/L (DS-02)
- North Site Boundary: 0.016 to 629 mg/L (UNC-01)

Historical zinc concentrations in surface water are summarized on **Figure 11**. Between 2005 and 2014, the total zinc levels measured in IG stormwater Outfall 001 (located upgradient of the West Swale) ranged from 19 mg/L (1st Quarter 2005) to 0.58 mg/L (1st Quarter 2014). As observed on **Figure 11**, the range of total zinc levels in the West Swale was considerably larger (and included higher zinc concentrations) than in Outfall 001.

Given that the Performance Standard utilized for the OU1 soil cleanup at the northwest portion of the Reeves Property was 10,860 mg/kg for zinc, it is likely that surface soils will continue to be a source of zinc in surface water in the area. Also, during the OU1 soil cleanup, the north pond area was graded to drain into the North Swale. Residual zinc-containing soils in the north pond area will likely continue to be a significant source for elevated zinc levels in surface water and sediment in the North Swale.

Between 2002 and 2009, ARCADIS performed an evaluation of sediment pore water concentrations in the same locations where surface and sediment samples were collected (ARCADIS, 2010). Sediment pore water concentrations are a function of constituent levels within the sediment as well as levels in groundwater flowing through the sediment. The following maximum zinc concentrations were reported:

- North Wetland: 0.60 mg/L (NW-01)
- Unnamed Creek: 2 mg/L (NW-02R)
- West Swale: 38 mg/L (DS-01)
- North Swale: 19 mg/L (DS-02)
- North Site Boundary: 35 mg/L (UNC-01)

Based on these data, along with the finding that groundwater was likely flowing to the surface at the northwest portion of the Reeves Property, surface water and sediment are likely being impacted by contaminated groundwater at the northwest portion of the Reeves Property.

3.3 ECT Report

IG contracted with Environmental Consulting Technology (ECT) in 2009 to assess potential sources of zinc that could warrant the development of improved BMPs to control zinc contributions to stormwater at the IG Facility. The study, which was documented in the report titled, “Zinc Assessment Report, Industrial Galvanizers-Tampa, October, 2009” (ECT, 2009), was not intended to be used as a tool for site characterization or to assist with the Superfund Site cleanup. Moreover, as explained below, this report did not present an accurate reflection of current facility conditions given numerous factual and procedural errors contained within it. In fact, the ECT report specifically noted that “the zinc concentrations reported in simulated runoff samples did not represent an anticipated zinc concentration in stormwater runoff.” The following conclusions were presented in the report:

- ECT air sampling data collected at perimeter locations around the IG Facility were all below the limit of detection (< 2.3 µg/m^3) for zinc.
- Air sampling data for zinc collected within various outdoor process areas ranged from below the limit of detection to 18 µg/m^3.
- Air sampling data for zinc collected within indoor process areas were measured at levels up to 160 µg/m^3.
- “Simulated stormwater runoff” samples (collected by pouring demineralized water on the roof) from the roof contained zinc concentrations that ranged from 1.62 to 32 mg/L.
- “Simulated stormwater runoff” samples (collected by pouring demineralized water over paved surfaces) from paved surfaces contained zinc levels that averaged

124.9 mg/L before - and 27 mg/L after - sealing of paved surfaces (one of several BMPs implemented).

- "Simulated galvanized product runoff" sample (collected by pouring demineralized water over freshly galvanized product) contained a zinc level of 52.6 mg/L.
- Unconsolidated media/soil samples collected around the IG Facility contained zinc concentrations that ranged from 74.2 mg/kg to 56,900 mg/kg. Leachable zinc levels (using SPLP method) from the samples ranged from 0.025 mg/L to 1.27 mg/L.
- A stormwater drain pipe that leads from an invert on the west side of the administration building and discharges into the Central Ditch appears to intercept groundwater. A sample of the water/groundwater flowing out of this ditch contained a zinc concentration of 4.23 mg/L.

The air sampling method utilized in the ECT investigation was not in accordance with existing EPA protocols and no attempt was made to validate the approach. A more appropriate protocol for ambient dust sampling would have been Compendium Air Method IO-2.1 *Sampling of Ambient Air for Total Suspended Particulate Matter and PM10 Using High Volume (Hv) Sampler*. In addition, the lack of detail provided about the protocols for the selection of sample locations makes it impossible to duplicate the assessment or validate the findings. In addition, environmental and production factors were not considered when selecting sample locations.

There are no known protocols for estimating "simulated runoff" by pouring demineralized water over the roof, the ground surface, and freshly galvanized product. Use of this sampling procedure would significantly over-estimate the amount of zinc that would run off during a storm event.

Since at least 2010, roof drainage from the main galvanizing building has not been discharged to the environment; it has been collected in large storage tanks and reused within the process. Also, freshly galvanized product has been stored under cover and is not moved outside until it has cooled/cured.

Given the foregoing, the ECT report should be viewed in its proper context as a tool for assisting IG with identifying Facility operations where BMPs could or should be developed. The ECT report pointed out that "the zinc concentrations reported in simulated runoff samples did not represent an anticipated zinc concentration in stormwater runoff." IG, in fact, did adopt and implement BMPs to address many of the issues discussed in the ECT report. However, the report should not be viewed as containing accurate depictions of the zinc loadings to stormwater actually being contributed by IG operations.

4.0 DISCUSSION

4.1 Site Characterization

Based on the information presented herein, the Reeves Property has had a long history (approximately 50 years) of industrial use and has been utilized for metal galvanizing, anodizing, and plating operations. Further, historical, pre-1996 activities associated with these operations at the Reeves Property have included unlined wastewater ponds, wastewater treatment systems, and associated piping. Historical operational milestones for the Reeves Property have included:

- 1960s - Originally developed and operated as Acme Plating and Galvanizing Company.
- 1970 - Acquired by Metal Coatings, Inc.
- 1971 – Metal Coatings, Inc. merged into the Southeastern Galvanizing Corporation, which later became the Southeastern Galvanizing Division of Reeves Southeastern Corporation.
- 1996 - Reeves Southeastern Corporation sold certain assets used in its galvanizing operation and leased approximately 10 acres of the galvanizing facility and related buildings to IG.
- 2000 - IG constructed a new galvanizing building at the southwest portion of the property.
- 2010 - VSG acquired IG.

Based on historical data reviewed and on communication with a former worker, uncontrolled industrial wastewater discharge occurred across the Reeves Property for many years prior to IG's operation at the property.

Based on a review of records of investigations conducted at the Reeves Superfund Site, it is clear that not all potential sources of contamination at the Reeves Property have been thoroughly remediated. As part of OU1, contaminated unsaturated zone soils were identified and removed from the Reeves Superfund Site. In addition to the wastewater evaporation ponds, the main area of excavation was the impacted soil at the northwest portion of the Reeves Facility. However, sediments within the drainage area located to the northwest of the Reeves Facility were not addressed as part of OU1. In addition, due to the fact that the old galvanizing facility had not been demolished at the time of the soil excavation (the building was demolished in 2007), potentially contaminated soils beneath the facility were neither assessed nor remediated (including the areas beneath the underground process tanks). Low pH process fluids, which contained high concentrations of metals, were reportedly released during historical operations at the old galvanizing facility during its operation for over 30 years. These fluids, which were denser than water, would be expected to soak into the sandy soils at the Reeves Property and then migrate vertically into the saturated zone beneath the facility. This would have resulted in the presence of a low pH contaminant mass within the saturated zone soils that was not excavated during OU1, which could be an ongoing source of dissolved groundwater contamination over time. Isopleth maps discussed in Section 3.2 indicate that contaminant mass in source areas (particularly near the old galvanizing building and ponds) is still likely contributing to groundwater contamination. This is further supported by a March 25, 2007 letter to Mark Mellon of IG written by A. Scott Starr of LFR (LFR, 2007b) that noted "*given the sampling results at DPT016 from the November 2006 investigation, a potential source area where high concentrations of metals were detected in groundwater was identified in the former dip tank processing area*" (i.e. the old galvanizing facility). In addition, the Second Five-year

Report for the Reeves Superfund Site (LFR, 2006b) stated, "*these exceedances appear unconnected with the area of prior acid discharge and former ponds and suggest an unidentified source may be impacting this area*".

Another location where insufficient data have been collected to characterize the potential source area includes the former pond area. The unlined ponds were excavated as part of the OU1 cleanup. However, based on information reviewed (Canonie, 1992), soil contamination was observed to approximately 12 feet below the ground surface (as much as 6 feet below the base of the ponds) during the investigation of the ponds. The actual depth of excavation during the OU1 cleanup was not specified in the remedial action report (Rust, 1997). In addition, no attempt was made to determine the lateral extent of soil impacts at depth around the pond (only the soils within the pond footprint were evaluated/removed). Isopleth maps discussed in Section 3.2 indicate that contaminant mass in this area is still contributing to dissolved groundwater contamination. In addition, this area is also likely contributing to surface water impacts, due to the upwelling groundwater in the northwest portion of the Reeves Property. Also, elevated zinc levels in soils may be contributing to elevated zinc concentrations detected in surface water in the North Swale, which receives runoff from the former pond area.

The state of the inorganic contaminants in the subsurface is a function of a variety of factors including Eh, pH, dissolved oxygen, alkalinity, cation exchange capacity, and other factors. Contaminants are typically found in a variety of states in the subsurface that include solid, sorbed, and dissolved. Typically, the highest concentrations below the groundwater table are not in the dissolved state. Rather, the solid or sorbed constituents are present at higher concentrations and act as a continual source for dissolved phase impacts. Without fully understanding the geochemistry of the Reeves Property, it is impossible to design a successful remedial strategy.

4.2 Site Impacts

Numerous, unsubstantiated claims have been made about IG's operations and their potential impact on the environment by ARCADIS. The following discussion provides further information relative to those claims, and the conditions at the Reeves Property.

In the spring of 2001, ARCADIS entered into an Operation, Maintenance and Monitoring (OMM) Agreement with Reeves under which ARCADIS agreed to conduct and complete all remedies required by EPA for OU2 and OU3 at the site. ARCADIS' remedial obligations under this Agreement apply to all OU2 and OU3 conditions that existed at the site as of the effective date of the Agreement - April 11, 2001.

Prior to 2001, the Reeves Property was the location of at least 35 years of metal finishing and hot dip galvanizing operations that started in the 1960s. These historical operations included the use of two unlined percolation ponds along the northern Reeves Property boundary from the mid-1960s until 1982 that were used for the disposal of acidic wastewater containing high concentrations of zinc, chromium, and iron. From 1982 to 1996, industrial wastewater was managed in an on-site pretreatment system located adjacent to the two ponds. Historical operation of the two ponds, the pretreatment system, the metal finishing and galvanizing plant, as well as probable spills/releases, during the 1960s and continuing through the 1980s caused significant quantities of pollutants to enter site soils, surface water, sediments and groundwater. These conditions led to EPA listing the site on the NPL in 1983,.

Contrary to allegations raised by ARCADIS, the site cleanup is still being driven by historical contamination. Based on a review of available historical data, the scale of the historical contamination would be expected to be substantially and materially greater than alleged post-1996 impacts.

Groundwater data from Monitoring Well S2 (one of the few wells for which pre-1996 data are available, and located outside the area influenced by ARCADIS' groundwater remediation pilot studies) provide an illustration of this situation. Prior to 1996, the zinc concentrations in groundwater at S2 ranged from about 107 mg/L in 1995 to 369 mg/L in 1989. More recently, during 2001 to 2013, zinc concentrations in groundwater at S2 have ranged from a low of 23 mg/L in 2003 to a high of 288 in 2000. These data indicate a gradual decreasing trend of zinc concentrations in groundwater over time and do not indicate significant impacts to groundwater post-2001.

A storm water-conveyance structure was constructed in 2004 to the north of the Reeves Property to prevent contaminated groundwater from discharging to the Unnamed Creek pursuant to the requirements of OU2 (Mod 3) (EPA, 2013). Despite the installation of the conveyance structure, the Florida Department of Environmental Protection (FDEP) was concerned that groundwater was continuing to upwell and contaminate surface water at the northwest portion of the Reeves Property (ARCADIS, 2011). Therefore, ARCADIS agreed to perform an evaluation of groundwater-surface water interactions at the Reeves Property. As noted by ARCADIS in 2011, "*data over the last few years indicate groundwater elevations in many wells are above the water levels in the staff gauges, which would imply groundwater has the potential to intermittently discharge to surface water during some part of the year*" (ARCADIS, 2011). ARCADIS installed staff gauges and shallow piezometers at the northwest portion of the site, and these data were included in tables in the 2012 Annual Monitoring Report (ARCADIS, 2013). However, despite repeated, unsubstantiated assertions made in the report about the potential impact of IG's operations on surface water, no mention was made about the new data from the staff gauges and shallow piezometers.

Figure 4 was created using the groundwater data provided in the 2012 Annual Monitoring Report. As shown on Figure 4, there is strong evidence that there is an upward gradient between groundwater in the Transition and Sand Zones and that shallow groundwater is discharging to the surface at the northwest portion of the Reeves Property. EPA has clearly acknowledged this evidence and, therefore, has proposed that a portion of the swales located in and near the northwest area of the Reeves Property be lined to prevent historically-contaminated groundwater from discharging to surface water in that area (EPA, 2013).

The area affected by the upwelling of groundwater entering surface water includes the area where the Unnamed Creek joins with the North and West Swales (which run roughly parallel with the northern and western edges of IG's leased parcel, respectively). ARCADIS' assertion that surface water is impacting groundwater quality is not valid given the upwelling locations where contaminated groundwater can affect surface water. In addition, because of the upwelling and the elevated zinc concentration in soil, surface water and sediment data reported by ARCADIS for locations within the upwelling area are likely more representative of soil and groundwater impacts than stormwater impacts.

The North Wetland receives stormwater primarily from road ditches located on the north and south sides of East Broadway Avenue, and runoff from the Peak Oil/Bay Drum Superfund Site and Master-Halco operations (formerly Reeves Southeastern Wire) located on the south side of East Broadway. In addition, the lack of apparent increasing trends in the available surface water data for the North Wetland and Unnamed Creek do not indicate appreciable impact from IG or VSG operations at the site.

Residual conditions at the site that are attributable to pre-1996 operations are a potential ongoing, contributing source of zinc contamination in stormwater, sediment, and groundwater. EPA has approved cleanup standards for groundwater at the site that include a groundwater cleanup standard for zinc of 10 mg/L; however, based on the upwelling of groundwater across

the northwestern portion of the Site, groundwater with zinc concentrations up to the cleanup standard of 10 mg/L could continue to adversely impact sediments and surface water.

EPA also has approved a soil cleanup standard for zinc of 10,860 milligrams per kilogram (mg/kg). Zinc-contaminated soils and sediments at these levels could contribute zinc at substantial concentrations in stormwater. Prior to implementing the OU1 remedy for soil and sediments, zinc concentrations in the soil and sediments at Reeves' two percolation ponds were as high as 209,474 mg/kg. In addition, prior to 1996 zinc concentrations in soil across other portions of the Site ranged from 6.3 mg/kg to 113,000 mg/kg, while zinc concentrations in sediment ranged from 80 mg/kg to 120,000 mg/kg.

EPA's 1995 determination that the OU1 cleanup had been satisfactorily completed was based on compliance with this 10,860 mg/kg standard in unsaturated zone soil. However, use of this cleanup standard allowed residual zinc concentrations at many areas of the site to remain in place so long as the soil concentrations were below 10,860 mg/kg for zinc, thereby leaving many thousands of pounds of zinc in the site soil and sediment. Similarly, analysis of the historical data collected by EPA and Reeves' contractors suggests that sub-grade soils in the vicinity of the former Reeves galvanizing building may also be continuing to contribute zinc and other contaminants to groundwater.

Starting in 1996, IG began implementing a series of improvements to limit and/or control pollutants that could potentially reach the ambient air, soil, and surface waters. Emissions of regulated air pollutants have been subject to applicable Florida state and local permit requirements, and baghouses have been used to control kettle emissions since at least 1996. Baghouses in use since 2003 are rated as having 99.9% capture efficiency for particulate matter. Similarly, stormwater management has been performed pursuant to applicable permit requirements specified by Florida state and local regulators. In addition, BMPs have been implemented and improved upon over the years.

Since 2010, IG has continued to implement additional BMPs in accordance with its stormwater permit requirements and discussions with state regulators. The facility's stormwater discharges are authorized by permit. Potential exceedances of stormwater general permit "benchmark" numbers for zinc are not relevant to determining the facility's environmental regulatory compliance status. The benchmark numbers are not enforceable discharge limits but rather are used to identify constituent concentrations at which the continued use of BMPs is appropriate. As stated in the EPA, Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, Part 6.2.1 (amended May 27, 2009), *"benchmark concentrations are not effluent limitations; a benchmark exceedance, therefore, is not a permit violation. Benchmark monitoring data are primarily for your use to determine the overall effectiveness of your control measures and to assist you in knowing when additional corrective action(s) may be necessary to comply with the effluent limitations in Part 2".*

The 2009 zinc assessment report by ECT was prepared in response to specific data requests by Florida state regulators, and was not intended, nor is it appropriate, for site characterization purposes. As ECT itself expressed within this report, the data contained in the report "do not represent expected stormwater zinc concentrations, but rather "are only valid to assess the relative quantities of zinc present" under ECT's biased sampling approach and overly aggressive/conservative sampling protocols.

4.3 Focused Feasibility Study

The Focused Feasibility Study (FFS) reports (ARCADIS, 2010 and 2011) proposed an alternate groundwater remediation strategy that included chemical injection. Reviewing the conceptual injection patterns illustrated in the FFS, it is apparent that source areas will largely not be

treated with chemical injection, rather only a small portion of dissolved constituents within the groundwater contamination plume will be treated. This approach is expected to be effective only in the short term, and additional injections will ultimately have to be conducted as the reductant concentrations dissipate over time. For full site remediation to occur, a dense grid of injections should be conducted throughout all source areas. In addition, the FFS figures indicate a planned injection radius of influence (ROI) of 20 feet in the Sand Zone and 10 feet in the Transition Zone. However, the ROIs observed during the pilot study for the Sand Zone ranged from 2 to 10 feet and 5 to 7 feet in the Transition Zone. Additional injection points will be required for complete coverage to occur. As stated in the FFS, "achieving uniform distribution will remain a challenge." Therefore, it is imperative that an adequate injection distribution be utilized at the Reeves Superfund Site.

In the FFS report, it is asserted that zinc concentrations in surface water are a result of IG's operations and that metals in surface water were preventing achievement of the OU2 ROD goals for groundwater. However, the Second, Five Year Review Report for the Reeves Southeastern Superfund Site (LFR, 2006b) expressly noted that zinc levels were present in all surface water samples collected at the Reeves Superfund Site at levels up to 13 mg/L between 1992 and 1995. This shows that elevated zinc levels already were present in surface water prior to IG's operations at the Reeves Property (IG's operations began in 1996). This Five Year Report also stated that "*discharge of site-impacted groundwater to Unnamed Creek and the drainage swale is the most likely source of this contamination, although other potential contributing sources are surface-water runoff from Queen Palm Drive and storm-sewer connections to the stormwater-conveyance structure from up gradient light-industrial sites*." Therefore, it is unclear why IG is now being blamed for a background condition at the Reeves Superfund Site that predates IG's operations. Further, potential discharges to air or surface water related to ongoing operations are expected to be very minor compared to the historical subsurface impacts caused by former operations at the Reeves property.

5.0 SUMMARY OF FINDINGS AND CONCLUSIONS

5.1 Reeves Property History

The Reeves Property has had a long history (approximately 50 years) of industrial use including metal galvanizing, anodizing, and plating operations, most of which predate IG's operations at the property. Operations by Reeves and other prior operators included unlined percolation ponds, industrial wastewater treatment systems, and associated conveyance systems. Uncontrolled industrial wastewater discharges reportedly occurred across the property for many years prior to the early 1990s, while key areas of historical operations were not fully addressed by the OU1 cleanup, including most notably the former galvanizing building and sediments in drainage areas northwest of the Reeves Property.

5.2 Reeves Property Hydrogeology

The following presents a summary of the hydrogeology of the Reeves Property:

- The land surface slopes generally to the west-northwest. Surface elevations range from approximately 42 feet above msl at the southeast corner to 28 feet above msl at the northwest corner of the Reeves Property.
- Surface soils at the Reeves Property have been categorized as the Myakka, Pomello, and St. Johns soils (USDA, 1989). These soils are similar in nature, and are fine-grain, sandy soils, with moderate to rapid permeability. These soils are acidic to moderately acidic, ranging from a pH of 3.6 to 6.5 standard units. Clay content is generally less than 2 percent. The soils are classified under the Unified Soil Classification System as SP and SP-SM (poorly graded sands to silty sands).
- The groundwater system beneath the Reeves Property consists of two major aquifer system units: the Surficial Aquifer (SAS) and the underlying Floridan Aquifer (FAS). A low-permeability unit (Hawthorn Group Intermediate confining unit) separates the Floridan Aquifer from the surficial groundwater (USGS, 1990), (Auther et al, 2008).
- The Surficial Aquifer is considered a Class IIB Aquifer, but is not currently utilized for groundwater supply (EPA, 2010). The Surficial Aquifer is comprised of undifferentiated sediments, which generally range in thickness from 9 to 37 feet (Canonie, 1992). Recent sampling data confirm that the undifferentiated surficial sediments are predominantly poorly graded sands and silty sands, which have been designated as the "Sand Zone" (LFR, 2011). In many areas of the Reeves Property, a gradational zone exists between the Sand Zone and the underlying Hawthorn Group (ICU). The gradational zone is comprised of clayey sand and has been designated as the "Transition Zone" (LFR, 2011).
- The groundwater flow direction in the Surficial Aquifer at both the Reeves Property and the Peak Oil/Bay Drum Superfund Site is toward the west-northwest (LFR, 2011). The average horizontal hydraulic gradient is approximately 0.01 ft/ft in the Surficial Aquifer.
- The groundwater horizontal seepage velocity was estimated to be approximately 690 feet per year (ft/year) in the Sand Zone and 10 ft/year in the Transition Zone.
- Rainfall infiltrates the permeable surficial materials and, after percolating downward to the water table, moves laterally and discharges to surface streams and wetlands (LFR, 2011). Water levels within the surficial groundwater

seasonally fluctuate and change rapidly in response to rainfall and other natural stresses.

- Downward groundwater gradients appear to exist in the areas near the old galvanizing facility, the plating building, the anodizing building, and the closed pond areas. In contrast, in the northwest portion of the Reeves Property, based on the upward gradient, the shallow depth to groundwater, and the sandy nature of the soils, available data indicate that groundwater is upwelling from the Transition Zone through the Sand Zone of the SAS and then flowing to the surface in the wetland areas.

5.3 Media Impacts

The following zinc level ranges in sediment have been measured between 1981 and 2012:

- North Wetland: 0.72 to 480 mg/kg (NW-01)
- Unnamed Creek: 20.5 to 31,400 mg/kg (NW-02R)
- West Swale: 2,610 to 16,000 mg/kg (DS-01)
- North Swale: 680 to 33,000 mg/kg (DS-02)
- North Site Boundary: < 14 to 28,000 mg/kg (UNC-01)

The following zinc level ranges in surface water have been measured between 1981 and 2012:

- North Wetland: 0.05 to 46 mg/L (NW-01)
- Unnamed Creek: 0.0087 to 2.2 mg/L (NW-02/R)
- West Swale: 0.93 to 66.6 mg/L (DS-01)
- North Swale: 0.18 to 15 mg/L (DS-02)
- North Site Boundary: 0.016 to 629 mg/L (UNC-01)

Additional media findings and conclusions include:

- Between 2005 and 2014, the total zinc levels measured in IG stormwater Outfall 001 (located upgradient of the West Swale) ranged from 19 mg/L in 2005 to a low of 0.58 mg/L in 2014. As observed above, the range of total zinc levels in the West Swale was considerably larger than in Outfall 001.
- Given that the Performance Standard utilized for the OU1 soil cleanup at the northwest portion of the Reeves Superfund Site was 10,860 mg/kg for zinc, it is likely that surface soils will continue to be a source of zinc in surface water in the area.
- During the OU1 soil cleanup, the north pond area was graded to drain into the North Swale. Residual zinc-containing soils in the north pond area will likely continue to be a significant source for elevated zinc levels in surface water and sediment in the North Swale.
- There is strong evidence that there is an upward gradient between groundwater in the Transition and Sand Zones and that shallow, historically-contaminated groundwater is discharging to the surface at the northwest portion of the Reeves Property. EPA has clearly acknowledged this evidence and, therefore, has proposed that a portion of the swales located in and near the northwest area of the Reeves Property be lined to prevent historically-contaminated groundwater from discharging to surface water in that area
- Levels of pH in groundwater were observed to range from 2.19 (DPT016) to 6.98 (G-3) units. Lower pH values were observed in the following locations: down-gradient of the former galvanizing building, at the northwest boundary of the

Reeves Property (in the area where upwelling groundwater is likely occurring down-gradient from the former pond location), and at the southwest corner of the Reeves Property, in the vicinity of the North Wetlands, indicating that a low pH plume in groundwater is migrating onto the Reeves Property from the south.

- The highest chloride level was observed down-gradient of the former galvanizing building (3,000 mg/L, DPT016). The chloride plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest.
- Elevated chloride levels in groundwater were not observed in the vicinity of the current galvanizing building, which indicates that groundwater impacts are not a result of recent operations by IG/VSG.
- The highest sulfate concentrations were measured at the northwest boundary of the Reeves Property in the area where groundwater is likely upwelling to the surface (up to 12,000 mg/L, DPT004), down-gradient from the former pond location (up to 4,200 mg/L, MW002D), and down-gradient from the former galvanizing building (up to 620 mg/L, DPT016). Sulfate impacts largely predate IG's operations at the Reeves Property.
- The highest lead concentrations were measured at the northwest boundary of the Reeves Property down-gradient from the former pond location (up to 1.3 mg/L, MW002D) and down-gradient from the former galvanizing building (up to 0.110 mg/L, DPT003). The lead plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest.
- The highest total chromium concentrations were measured at the northwest portion of the Reeves Property down-gradient from the former pond location (up to 3.4 mg/L, MW002D) and down-gradient of the former galvanizing building location (up to 0.400 mg/L, DPT002). The total chromium plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest.
- The highest zinc concentrations were measured down-gradient of the former galvanizing building (up to 550 mg/L, DPT016) and at the northwest boundary (up to 1,500 mg/L, MW009) of the Reeves Property in the area where groundwater is likely upwelling to the surface down-gradient from the former pond location. The zinc plume extends from the former galvanizing building to outside the Reeves Property boundary to the northwest. Elevated zinc levels in groundwater were not observed in the vicinity of the current galvanizing building.
- Numerous volatile organic compounds (including vinyl chloride) were detected in groundwater above FDEP Groundwater Cleanup Target Levels at the subject Reeves Property and are likely a result of groundwater impacts from the up gradient Peak Oil/Bay Drum site.

5.4 Environmental Consulting Technology (ECT) Report and BMPs

In 2009, Environmental Consulting Technology (ECT) attempted to evaluate areas where ongoing operations at the IG Site could be contributing zinc to the stormwater and, therefore, could necessitate the development of BMPs (ECT, 2009). The evaluation included collection of "simulated stormwater runoff", ambient air, and surface soil samples. Unfortunately, the report contained numerous factual and procedural errors and does not present an accurate picture of current conditions. The ECT report also pointed out that "the zinc concentrations reported in simulated runoff samples did not represent an anticipated zinc concentration in stormwater runoff."

Numerous stormwater BMPs were implemented beginning in the late 1990s soon after IG leased the Facility, and have continued to be adopted and improved during subsequent years in order to prevent zinc from migrating off-property. These have included:

- Site paving;
- daily sweeping of the property;
- material dressing conducted under cover;
- Central Ditch lined with concrete, baffles with limestone gravel and filters installed; and
- roof rainwater collection system installed.

5.5 Site Characterization

Although numerous investigations have been performed at the Reeves Superfund Site to date, there are several potential source areas that have not been thoroughly characterized. Areas of the Reeves Property that appear to be ongoing sources of groundwater contamination include the former galvanizing building and the former percolation pond areas.

Potential pathways for contaminant migration should also be assessed as part of the remedial design efforts. For example, vertical gradients (which suggest both downward and upward migration of groundwater at different parts of the Reeves Property) in groundwater have been ignored in prior investigations and need to be assessed.

5.6 Focused Feasibility Study

The approach for groundwater remediation proposed in the Focused Feasibility Study (FFS) reports (ARCADIS, 2010 and 2011) was in-situ chemical injection. Based on a review of the conceptual chemical injection patterns illustrated in the FFS, it is apparent that source areas will largely not be treated with chemical injection, but rather only a small portion of the dissolved COC plume will be treated. This will only be effective in the short term, and additional injections will ultimately have to be conducted as the reductant concentrations dissipate over time. For full Site remediation to occur, a dense grid of injections must be conducted throughout all source areas.

In the FFS report, it is asserted that zinc concentrations in surface water are a result of IG's operations and that metals in surface water were preventing them from achieving the OU2 ROD goals for groundwater. Zinc was present in all surface water samples collected at the Reeves Superfund Site at levels up to 13 mg/L between 1992 and 1995. This shows that elevated zinc levels were present in surface water prior to IG's operations at the Facility (IG's operations began in 1996). Further, the Five Year Report stated that "discharge of site-impacted groundwater to Unnamed Creek and the drainage swale is the most likely source of this contamination". Contemporaneous records and differences in operational practices between the Reeves era and post-1996 operations indicate that potential discharges to air or surface water related to ongoing operations would be minor compared to the historical subsurface impacts caused by former operations at the Reeves property.

5.7 Summary of Conclusions

In summary, the preponderance of evidence suggests that the OU2 and OU3 remedies continue to be driven largely by pre-1996 conditions, and not by alleged additions of pollutants from IG operations. This conclusion is supported by a review of the site data, which show no significant increasing trends in zinc levels in surface water or groundwater relative to historical contaminant levels after IG began operations in 1996. In fact, zinc concentrations in groundwater have shown an overall decreasing trend in groundwater downgradient from the Reeves Property. ARCADIS commenced its work on behalf of Reeves at the site in 2001. Since that time, zinc and other metals contained in stormwater discharges and airborne emissions have been authorized pursuant to validly-issued permits, and data indicate that alleged impacts from these materials, discharges and/or emissions are limited or *de minimis* when compared to the substantial impacts that were found at the site due to pre-1996 operations. Moreover, IG and VSG have proactively taken major steps to control and minimize the potential effects from their galvanizing operations through the development of numerous BMPs, in cooperation with FDEP authorities, as noted above.

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